IMPACT OF VEE-MAPPING AND DEMONSTRATION INSTRUCTIONAL TEACHING STRATEGIES ON STUDENTS' ACADEMIC ACHIEVEMENT IN SCIENCE ON THE CONCEPT OF ENERGY IN SCHOOLS IN UYO EDUCATIONAL ZONE, NIGERIA.

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ABSTRACT

The significance of science to humanity is unique and the steps taken by researchers to improve on the teaching and learning of students' achievement in Basic Science and Technology (BST) is obviously seen to be encouraging in Nigeria. As such the poor academic achievement in the concept of science (energy) is observed to be poor and this negative development has been link to teachers' weakness to adopt a teaching strategies that suit the teaching and learning of BST, there by resulting in poor achievement in BST. This has given way to the present research titled comparative effects of demonstration, vee-mapping and lecture teaching strategies on students' achievement on the concept of energy in schools in Uyo educational zone. Three purpose of study, three research question and three hypotheses were provided to guide the study. Relevant learning themes related to the main and sub-variables were reviewed, Quasi-experimental research and non-randomized pre-test, post-test design were adopted for the research. The study sample comprised of 200 JS3 Basic Science students in two intact classes in two public coeducational secondary schools selected from the study area using purposive sampling technique. The instrument for the research was called (BSAT) science practical achievement test checklist and indices of 0.78, 0.84 and 0.94 respectively were used to gather the data for the study. The data obtained from all the tests were analysed

using mean, standard deviation, Analysis of Variance (ANOVA) and Analysis of Covariance (ANCOVA). The results showed that there was no significant difference and the mean achievement and science scores of students on the concept of energy when taught using vee-mapping and when taught using demonstration instructional strategies, gender was a significant determinant of student academic achievement. Moreso, it was recommended that science teachers should make effective use of both vee-mapping and demonstration strategies in teaching the concepts of science (Energy).

KEYWORD: Demonstration, Vee-mapping, Lecture Teaching Methods, Students Academic Achievement, Science Concept.

INTRODUCTION

Science can be best express as the secret and basic foundation for the existence of humanity. It can also be describe as the projector and manipulator of the beauty of nature in the entire universe (Brain, 2023). Scientific research processes can be described as identifying a problem, gathering data, analysing the data and interpreting the gather result (Fraenke and Wallen, 2006). Scientific research develops student's higher level of thinking skills such as asking questions doing research, solving problems and communicating effectively (Cureras's Lee, Hart and Deaktor, 2005).

Science provides ways of searching and acquiry information and also accumulates knowledge resulting from research (Okoro, 2013).

Science is a systematic investigation of nature with a view to understand and harnessing them to serve human needs. Science may also be regarded as a systematic search for knowledge from disciplines such as: Botany, chemistry, physics, mathematics and geophysics. Science is a system of thought that requires the application of reasoning and thinking processes to produce new knowledge and innovations that will enhance human understanding of his basic environment. Scientific research reveals that science is used in the world's technological breakthrough and economic development, advancement in economy, politics, education, culture, industries, religion et science helps in the development of education, maintenance of security, development of mental reformation and in the understanding of the universal concepts as well as it enormous changes.

Science concepts are taught in Junior and Secondary schools respectively to enable build and equipped potential science university professionals' from the scratch, a good knowledge of science good be impacted on the learners in the secondary and junior education with the help of adopting a good teaching method such as demonstration, lecture and guided teaching strategies to see how the science education mentality of the learners could be improve (Sunday, 2021). Basic science and technology curriculum adopted in 2012 was formerly integrated science in 1970 and basic science in 2017. Basic science and technology is a product of restructuring and adopting the concept of integration unlike other core areas of science subjects such as Chemistry, Physics and Biology. The basic science and technology, acquire basic knowledge and skills as well as to prepare students for further studies in science and technology (FME, 2012). The research tends to work on the concept of energy which cuts across the subject of major sciences which include; chemistry, biology, physics and basic science and it is an important topic in basic science and technology curriculum. It cuts across all levels of education from nursery to tertiary. The concept of energy has been in primary and junior secondary curriculum from the introduction of primary science and integrated curricula. It is prominent in the 9 year basic education curriculum from BSE 1 – 3 (FME, 2012)

and primary 4-6 (FME, 2012) under the theme 'Basic technology'. It is also prominent in the 9-year basic education curriculum basic science and technology JS1-3 (FME, 2012) under the theme Basic science in senior secondary education curriculum for chemistry. SS1-3, chemical energy is being explored (FME, 2007). In biology, the concept of energy is also prominent as a topic which is Energy transformation in nature which is a sub-theme under the theme "the organism and its environment" (FME, 2009). In physics, the various forms of energy are being explored in the themes "conservation principles, fields at Rest and in motion, energy quantization and quality of matter", hence, this study intends to adopt three teaching methods to teaching science concept (energy) in other to enhance students achievement in secondary schools in Educational Zone in Uyo Local Government Area of Akwa Ibom State.

STATEMENT OF THE PROBLEM

The importance of science in the development of the society and the efforts of researchers to improve on its teaching and learning notwithstanding students achievement in the concepts of science (energy) seems to be poor and this has been link to poor teaching methods adopted by researchers to teach the concepts of energy.

Chief Examiners Report in the 2021/2022 WAEC INECO Result reveals that students performance in science related disciplines are poor and this has denied them admission to tertiary institution to study their dream courses and this negative development have necessitated the present research to see how the adoption of demonstration, vee-mapping teaching strategies could enhance the achievement of student in science concepts in public schools in Uyo, Akwa Ibom State.

SIGNIFICANCE OF THE STUDY

The findings of this study will encourage learners to improve on the concept of science and the subject it is related to.

Science teachers will be provided with empirical data for making the choice of appropriate teaching methods and strategies for teaching the concept of energy.

Government and other professional bodies like STAN, TRCN, CSN, BSA will be guided on the strategies for improvement of science concept and the strategies for improvement of science concept and academic achievement.

Science curriculum planners and school administrator will acquire insights for future review on educational policies with respect to professional development and provision of effective teaching and learning strategies.

Researchers will be motivated to evaluate and analysed the impact of teaching methods and strategies on the teaching and learning of science concept and students achievement on the concept of energy in science.

PURPOSE OF THE STUDY

The purpose of the study was to investigate the relative effectiveness of demonstration, guided inquiry and lecture teaching strategies on student achievement on the concept of energy in Uyo and the following objectives were formulated to guide the study.

- Compared the mean academic achievement scores of science (energy) on students in demonstration and those in guided inquiry classes.

- Compare the mean science scores on the concept of energy on students in vee-mapping and those in demonstration classes.
- Compare the mean academic achievement, scores on the concept of energy on male and female students in guided inquiry and those in demonstration.

RESEARCH QUESTION

The following research questions were raised.

- What are the differences among the mean academic achievement scores of science students on the concept of energy when taught using demonstration teaching method and when taught using vee-mapping?
- What are the difference among the mean scores of science student on the concept of energy when taught using vee-mapping and when taught using demonstration method?
- What are the differences among the mean academic achievement scores of male and female students on the concept of energy when taught using vee-mapping and when taught using student - demonstration method?

RESEARCH HYPOTHESES

The following null hypotheses will be tested at 0.05 level of significance.

- There is no significant difference among the mean academic achievement scores of science students on the concept of energy when taught using vee-mapping and when taught using demonstration.
- There is no significant difference among the mean scores of science student on energy when taught using vee-mapping and when taught using demonstration.
- There is no significant difference in the mean academic achievement scores of male and female science students on the concept of energy when taught using vee-mapping and when taught using demonstration method.

RELATED LITERATURE

Social constructivism theory of Lev Vygotsky (1930)

Lev Vygotsky (1896-1934), a Russian psychologist and philosopher in the 1930's is most often associated with the social constructivist theory. He proposed a theory of development of 'higher psychological functions' that saw human psychological development as emerging through interpersonal connections and actions with the social environment. He proposed that children's understanding is shaped not only through adaptive encounters with the physical world but through interactions between people in relation to the world. Vygotsky's theory emphasizes that human development is socially situated and knowledge is constructed through interaction with others. He observed how higher mental functions developed through these interactions and also represent the shared knowledge of a culture.

Vygotsky also emphasized the principle of "Zone of proximal development" (ZPD): that through the assistance of a more capable person, a child is able to learn skills or aspects of skills that go beyond the child's actual development of maturation level. The low limit of the ZPD is the level of development reached by the child working independently (child's actual development level). The upper limit is the limit of potential skills that the child is able to reach

with assistance of a more capable instructor. The theory emphasizes the influences of cultural and social contexts in science learning and supports a discovery model of learning. This type of model places the teacher in an active role while the students' mental abilities develop naturally through various paths of discovery. Vygotskian Principles in the Science Classroom can be described as follows:

- The zone of proximal development can be used to design appropriate situations during which the student can be provided with appropriate support for optimal out of school experiences which should be related to school experiences. Pictures, news clips and personal stories incorporated into classroom activities provided by the students with a sense of oneness between their community and learning.

The implication of this theory is that learning and teaching strategies could be acquired optimally when the teacher act as a facilitator provides the learner with the experiences and the instructional materials through which the learner requires to understand the concepts taught.

THE CONCEPT OF ENERGY

Energy is necessary for all life including the activities of human beings. It is not easy to say what energy is but we can describe what it will do. It enables things to move in all sorts of ways. It enables things to get hot and give out light. In all of these, work is done and the SI Unit of energy is joules. It has the same unit as work (STAN, 2011) and (Ababio, 2011). Energy is defined as the capacity to do work (Anyakoha, 2011). Anything that is capable of doing work has energy.

SOURCES OF ENERGY

The sun is the primary source of all energy available on the earth. Other sources energy can be regarded as stores of energy or secondary sources. These include food, wind, heat, running water, wood, crude oil, coal, magnets, chemicals all combustible substances, electric cells and atomic reactions (STAN, 2011).

FORMS OF ENERGY

There are many forms of energy. These are (i) mechanical energy (ii) heat or thermal energy (iii) light energy (iv) chemical energy (v) electrical energy (vi) atomic or nuclear energy (vii) solar energy (viii) magnetic energy (ix) sound energy. These forms of energy are of immediate practical use in daily life. For example, an electric motor uses electrical energy to drive an electric train, a steam engine uses heat energy to more the coaches, sound energy causes the diaphragm of a microphone to vibrate, the chemical energy in the food we eat causes us to grow and also provides us with muscular energy for our physical activities.

- Mechanical Energy

This the sum total of kinetic and potential energy in an object that is used to do work. In other words, it is energy in an object due to its motion or position or both. It is the energy acquired by the objects upon which work is done. Mechanical energy is classified into two types-potential energy and kinetic energy.

Potential energy (P.E.) is the energy possessed by a body by virtue of its position or state. Such

stored energy is used to do work when the body is free to move. A body may have a potential energy due to its positions in a force field. If the force field is the gravitational field, the body is said to possess a gravitational potential energy. The stone resting on top of a table has gravitational potential energy due to its height above the ground level. If the body of mass is in and the height of the table is h, then the gravitational potential energy (PE) is given by.

PE = mgh ---- (1)

Kinetic Energy (KE)

Kinetic energy (KE) is the energy possessed by a body by virtue of its motion – samples of kinetic energy are: (i) a student running a race, (ii) an object pulling freely under gravity (iii) wind or air in motion (iv) electrical charges in motion (v) a moving bullet or a moving hammer head.

Measurement of Mechanical Energy

(a) **Potential Energy (PE):** Gravitational potential energy depends on the weight and the height of an object above the earth's surface. If a hammer head is lifted some metres above the ground, work has been done in lifting the hammer against the weight of the hammer head. The work put into the lifting of the body is stored as potential energy at the height, h above the ground. If the mass of the body is m and the height of the body above the reference level is h, then the gravitational potential energy is mgh using equation (1). To measure gravitational potentials energy; the mass m of the body and its height above a reference level is measured.

Heat Energy

Heat is the form of energy used for cooking? It is a form of energy called thermal energy (Anyakoha, 2011). It is the energy transferred from a hot object to a cooler object as a result of temperature difference. Temperature is the degree of hotness or coldness of an object. A hot body is at a higher temperature than a cold body. Temperature rises or falls as the body gets hotter or cooler respectively. Thermometers are used to measure temperature. The commonest thermometer available in school laboratories is the Celsius-scale thermometer in which the temperature is measured in degree Celcius. Another unit of measuring temperature is Fahrenheit (F). Kinetic theory explains that since the molecules of a substance are in continuous random motion, they possess kinetic energy. The temperature of a body is a measure of the average kinetic energy of its molecules. Addition of heat to a substance causes an increase in the speed of motion of the molecules and thus an increase in its temperature. Removal of heat from the body leads to a decrease in the motion of molecules and hence reduction in their average kinetic energy. This results in a decrease in temperature. Temperature is therefore related to the average kinetic energy.

EFFECTS OF HEAT IN AN OBJECT

The effects of heat include:

1. Change in temperature of the body
2. Change of state of the body
3. Expansion of the body
4. Change physical properties of the body
5. Thermionic emission

6. Chemical change
7. Changes in pressure (Anyakoha, 2011)

Transfer of Heat Energy

Energy can be transferred from one place to another. Heat energy can be transferred through such methods as conduction, convection and radiation.

Conduction: This is the flow of heat from a hot body to a cold body by itself. This requires a medium. Example is the transfer of heat from one end of a rod to another end without any movement of particles of the rod. It is not all the substances that can conduct heat. Some substances are good conductors. Examples are metals. Others are bad conductors, example liquids and gases. Bad conductors do not conduct heat readily.

Convection: This is the transfer of heat by the movement of liquid molecules. Heat flows from the bottom to the top by the actual movement of the liquid molecules. As the water is heated, molecules acquire heat energy and move further apart. The hot liquid becomes less dense than the colder liquid above. The molecules from the bottom rise to the carrying the heat energy with them. The molecules from above sink to take the place of the risen molecules and they in turn are heated and the cycle continues until the water boils.

RESEARCH METHOD

Research Design

A quasi-experimental factorial research design was adopted for the study used. It was a 3 x 2 x 2 factorial design. It is a non-randomized pretest, post-test non-equivalent comparative group. The study is described as non-randomized since intact classes from selected schools.

The Area of Study

The area of study is an area were a research is carryout. The study was carried out in upper basic level of the 9-year basic education in Uyo Local Government Area of Akwa Ibom State. Akwa Ibom State is located at about 55km from the coastal plains of Southern Nigeria. It extends from latitude $4^{o}55'$ to $5^{o}05'$ North and longitude $7^{o}54'$ to $8^{o}00'$ East. Uyo is bounded by Ikono, Ibiono Ibom, Itu and Northern Uruan Local Government Area in the North, Uruan Local Government Area in the East, Ibesikpo Asutan, Nsit Ibom and Etinan Local Government Area in the South and Abak Local Government Area in the West, Uyo occupies almost a central position in Akwa Ibom State and is easily accessible from Itu, Ikot Ekpene, Etinan and Abak Local Government Area.

The people of Uyo are predominantly farmers and traders. Some are transporters, property developers and craftsmen. They are of the Ibibio stock and speak Ibibio language. Uyo people are mostly Christians. The population is made up of 153,113 males and 156,460 females (FGN, 2006) as cited in Aksgonline (2012). Uyo plays host to the University of Uyo, a Federal Institution established in 1991; the National Open University of Nigeria and the Uyo City Polytechnic. There are 12 co-educational secondary schools in Uyo. Uyo is chosen because the researcher resides there and is familiar with the educational problems of the area.

Population of the Study

The population of the study comprised all the 6353 Junior Secondary Three (JS3) Basic Science and Technology students for the 2017/2018 academic session in all the twelve public co-

educational secondary schools in Uyo Local Government of Akwa Ibom State (SSEB, 2017). The population is chosen since the student are preparing for examination. They are more stable than JSS1 and JSS2 and must have covered much of the content of the concept chosen for this study.

Sample and Sampling Technique

A total of 200 JS3 Basic Science and Technology students in two intact classes in the two schools selected in the study area made up the study sample. Purposive sampling technique was used to select the two schools for the study. They criteria are'

(i) Schools that have qualified professional Basic Science and Technology teachers with at least 5 years of teaching experience as subject teacher in JS3 classes.
(ii) Schools that have a well equipped and functional science laboratory.
(iii) Schools that are currently presenting candidates for the Junior Secondary School Certificate Examination (JSSCE).
(iv) Public co-educational schools
(v) Schools that have at least four (4) arms of JS3 classes.

Four schools made the criteria and a simple random sampling technique was used to select two schools from the populations the first arm of JS3 classes (JS3 A) in each of the schools was also selected.

RESEARCH INSTRUMENTS

Three researchers constructed an instrument called Basic Science and Technology Achievement Test (BSTAT). Checklist was used to gather data for the study.

BASIC SCIENCE AND TECHNOLOGY ACHIEVEMENT TEST (BSTAT)

This was a fifty (50) item multiple choice test drawn from the concept of energy in Basic Science and Technology. To ensure content coverage and even distribution of the test items. Each question has 4 options A, B, C and D with only one correct answer. The test was used to measure the achievement of students in the concept of energy. The post-test was re-shuffled version of the validated BSTAT used for pre-test measurements.

RESEARCH PROCEDURE

The research obtained permission from the principals of the two schools that were selected for the study. Permission granted, the researcher met the subject teachers of JS3 basic science and technology and informed them of her mission and solicited their co-operation as research assistants. This was followed by a random selection of one intact class each from among the various arms of JS3 in the two selected schools. The two schools were grouped into 1 and 2. Research assistants were thoroughly trained by the researcher using two days for each of them on how to use the validated lesson notes with the instructional materials prepared by the researcher. The assistant for group 1 was briefed on the use of vee-mapping lesson package while that of group 2 was briefed on the use of student-demonstration package. At the end of the two day training, each subject teacher (research assistant) was subjected to mock teaching session to assess their capability. Necessary corrections were respectfully done to ensure their mastery of the packages before treatment. BSTA was administered as pre-test by the research assistants to their respective groups before the commencement of treatment. The teaching of the concept of energy lasted for four weeks in each of the selected schools. At the end of the

forth week the science achievement test questionnaire was administered to the students. Also, a reshuffled version of BSTAT was re-administered as post-test after four weeks of treatment. This was followed by Science Achievement Test (SAT) which was done using on the spot assessment procedure. All were done under strict supervision of the researcher. Students pre-test and post-test and science process skills acquisition test scripts were retrieved immediately after the tests by the researcher, marked, collated and analysed.

METHOD OF ANALYSIS

The data generated from pre-test and post-test were analysed using Mean, Standard Deviation Analysis of Variance (ANOVA), and Analysis of Covariance (ANCOVA) statistics. Mean scores and standard deviation were used for answering the research questions, ANOVA and ANCOVA were used in testing the eight research hypotheses formulated. All the null hypotheses were tested at 0.05 alpha level of significance. Instructional strategies with higher mean scores were better than those with lower mean scores. The null hypotheses were rejected when the calculated F-value was greater than or equal to the P-value.

RESULTS AND DISCUSSION

The summary of data analyses, results, and discussion of findings are presented in this chapter. It is organized under the following subheadings: Data Analysis and Results, Summary of Findings and Discussion of Findings.

DATA ANALYSIS AND RESULTS

In this section, the summary of results used in answering the eight research questions and testing the eight null hypotheses formulated to guide the study are presented and interpreted variable by variable.

Research Question 1: What is the mean academic achievement scores of Basic Science and Technology (BST) students on the concept of energy when taught using vee-mapping and when taught using demonstration method?

Mean and standard deviation of students' pre-test and post-test scores classified by treatment groups

Treatment Groups	Sample Size	Pre-test		Post-test		Mean Gain Score
		$\bar{x}$	SD	$\bar{x}$	SD	
Vee-mapping	56	38.24	9.26	52.41	11.08	15.20
Demonstration	59	30.75	9.98	46.37	12.14	15.62

The table shows the pre-test and post-test mean scores and standard deviation of scores of the two groups of students taught using vee-mapping and student-demonstration teaching/learning strategies. The pre-test mean scores of 38.24 and 30.25 for those in vee-mapping and student-demonstration, respectively; and the post-test mean scores of 50.41 and 46.31 for those in vee-mapping and student-demonstration, respectively, show that the student-demonstration group had a higher mean gain (15.62). The post-test standard deviation scores of 11.8 and 12.14 for those in vee-mapping and student-demonstration groups, respectively, show that the scattering of the raw scores from the mean is wider in the

student-demonstration group. This indicates that both the mean and the standard deviation scores of the student-demonstration group are higher than those of the students in the vee-mapping group. Expectedly all the groups had post-test mean scores that are higher than the pre-test mean scores. Whether the differences between the mean scores of the two groups taught using vee-mapping and student-demonstration were statically significant was assessed by testing of hypothesis one.

Hypothesis One: There is no significant difference among the mean academic achievement scores of Basic Science and Technology (BST) students on the concept of energy when taught using vee-mapping and when taught using student-demonstration method.

Summary of Analysis of Covariance (ANCOVA) of the students' post-test scores classified by treatment groups with pre-test scores as covariable

Source	Type III Sum of Squares	df	Mean square	F	Sig.	Decision at p < .05 alpha
Corrected Model	6691.66[a]	2	3345.83	38.83	.00	S
Pretest	5644.28	1	5644.28	65.50	.00	S
Treatment	43.13	1	43.13	.50	.48	Ns
Error	9651.07	112	86.17	-	-	-
Total	295997.00	115	-	-	-	-
Corrected Total	16342.73	114	-	-	-	-

a. R Squared = .409 (Adjusted R Squared = .399)

The calculated F-ratio for the effect of instructional strategies at df 114 is .50, while its corresponding calculated level of significance is .48 alpha. This level of significance is greater than .05 in which the decision is based; indicating that there was no significant difference in the academic achievement of students in the concepts taught using vee-mapping and student-demonstration teaching/learning strategies. With the observation, null hypothesis 1 was upheld. This means that the achievement scores of students on the concept of energy when taught using vee-mapping and when taught using student-demonstration strategy was comparable.

Research Question 2: What are the mean scores of BST science student's achievement when taught the concept of energy using student-demonstration and when taught using vee-mapping method?

Mean and Standard Deviation of science students achievement test (SST) scores classified by treatment groups

Treatment groups	N	Mean Score	Std. Dev'n	Std. Error of Mean
Vee-mapping	56	65.05	8.05	1.08
Demonstration	59	62.47	7.90	1.03

Shows the science achievement test (SAT) mean and standard deviation scores of the two groups of students taught using vee-mapping and student-demonstration teaching/learning strategies. The SAT mean score of the students in the vee-mapping group is 65.05 while their standard deviation score is 8.05. For those in the student-demonstration group the SAT mean is 62.47, while their standard deviation score is 7.90. The observed mean

and standard deviation scores show that the scattering of the raw scores from the mean is wider in the vee-mapping group. This indicates that the SAT mean score and the variability of the raw score from the mean is higher in the vee-mapping group than in the student-demonstration group. Whether the differences between the mean scores of the two groups taught using vee-mapping and student-demonstration were statistically significant is assessed by testing of hypothesis two.

Hypothesis Two: There is no significant difference among the mean scores of BST students on science process skills acquisition when taught the concept of energy using vee-mapping and when taught using student-demonstration method.

Summary of Analysis of Variance of the students' science achievement test scores classified by treatment groups

Source	Type III Sum of Squares	df	Mean square	F	Sig.	Decision at p < .05 alpha
Treatment	.03	1	.03	.00	.98	ns
Error	5555.50	112	49.60	-	-	-
Total	474449.00	115	-	-	-	-
Corrected Total	7368.64	114	-	-	-	-

a. R Squared = .246 (Adjusted R Squared = .233)

The calculated F-ratio for the effect of instructional strategies on the science students at df 1, 114 is .00, while its corresponding calculated level of significance is .98 alpha. This level of significance is greater than .05 on which the decision is based; indicating that there was no significant difference in the students' science subject when taught the concept of energy using student-demonstration and when taught vee-mapping teaching/learning strategies. With the observation, null hypothesis 2 was upheld. This means that there is no significant difference among the mean science scores of students on the concepts taught using the two strategies. In other words, the science student scores in the two groups was comparable.

Research Question 3: What is the mean academic achievement scores of male and female BST students on the concept of energy when taught using vee-mapping and when taught using student-demonstration method?

Mean and standard deviation of students' pre-test and post-test scores classified by treatment groups and gender

Treatment Groups	Gender	Sample Size	Pre-test		Post-test		Mean Gain Score
			$\bar{x}$	SD	$\bar{x}$	SD	
Vee-mapping	Male	16	39.75	9.88	57.13	12.31	17.38
	Female	40	36.20	8.93	50.52	10.10	14.32
Demonstration	Male	29	32.76	11.14	50.69	14.17	17.93
	Female	30	28.80	8.45	42.20	8.02	13.40

Shows the pre-test and post-test mean scores and standard deviation of scores of the male and female students in the two groups taught using vee-mapping and student-

demonstration strategies. The pre-test mean scores of male and female students in the vee-mapping teaching/learning group displayed are 39.75 and 36.20 respectively, and their standard deviation scores are 9.88 and 8.93, respectively. The post-test mean scores are 57.13 and 50.52 for male and female students in the vee-mapping group, respectively, while their standard deviation scores are 12.31 and 10.10, respectively. The mean gain scores for male and female students are 17.38 and 14.32 respectively.

With respect to those in the student-demonstration group, the pre-test mean scores of the male and female students displayed are 32.76 and 28.80 respectively, and their standard deviation scores are 11.14 and 8.45, respectively. The post-test mean scores are 50.69 and 42.20 for male and female students, respectively, while their standard deviation scores are 14.17 and 8.02, respectively. The mean gain scores for male and female students are 17.93 and 13.40, respectively.

These observations show that the male students in student-demonstration teaching/learning group had a highest mean gain scores followed by the males in the vee-mapping group; the females in the vee-mapping group and the females in the student-demonstration group in decreasing order. Also, the scattering of the raw scores about the post-test mean was widest for the males in the student-demonstration group. Whether the differences between the mean scores of the two groups taught using the two teaching strategies by gender were statistically significant is assessed by testing of hypothesis three.

Hypothesis Three: There is no significant difference among the mean academic achievement scores of male and female BST) students on the concept of energy when taught using vee-mapping and when taught using student-demonstration method.

Summary of Analysis of Covariance (ANCOVA) of male and female students' post-test scores classified by treatment groups with pre-test scores as covariate

Source	Type III Sum of Squares	df	Mean square	F	Sig.	Decision at p < .05 alpha
Pre-test	4749.90	1	4749.90	58.15	.00	s
Treatment	136.57	1	136.57	1.67	.20	ns
Gender	614.72	1	614.72	7.53	.01	s
Treatment * Gender	16.68	1	16.68	.20	.65	ns
Error	8984.83	110	81.68	-	-	-
Total	295997.00	115	-	-	-	-
Corrected Total	16342.73	114	-	-	-	-

a. R Squared = .450 (Adjusted R Squared = .430)

The calculated F-ratio for the effect of instructional strategies on the mean academic achievement scores of male and female BST students at df 1,114 is 1.67, while its corresponding calculated level of significance is .20 alpha. This level of significance is greater than .05 in which the decision is based, indicating that there was no significant difference between the academic achievement of students in the concepts taught given the instructional methods used. However, the F-cal value for the main effect of gender at df 1,114 was 7.53 while its significant level is .01.

SUMMARY

The data obtained from all the test were analysed using mean, standard deviation, analysis of variance (ANOVA) and analysis of covariance (ANCOVA) and the breakdown is as follows.

1. There was no significant difference among the mean achievement scores of students on the concept of energy when taught vee-mapping and when taught using demonstration strategy.
2. The effect of gender on the students achievement was statistically significant, gender is a significant detector or determinant of basic science and technology achievement in the concept of energy when taught using demonstration teaching strategy.
3. There was no significant difference among the mean achievement scores of student on the concept of energy when taught using vee-mapping and when taught using demonstration method.

CONCLUSION

With regards to the findings, it is hereby concluded that of the two teaching strategies enhances student's achievement in the concept of energy in Basic Science and Technology (BST). It was also recorded that gender is a significant factor of students' academic achievement in science and in the concept of energy.

RECOMMENDATION

- Government incollaboration with other professional bodies and agencies like STAN should endeavour to engage in the sponsorship of vee-mapping and demonstration teaching strategies.
- Basic Science and Technology (BST) teachers should make effective use of both vee-mapping and demonstration teaching strategies in the teaching of the concept of energy in junior secondary schools.
- Teacher's incolloboration with curriculum developers should the teaching strategies in teaching the practical class that involves the concept of energy.

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